

Low-Cost High-Performance Hall Thruster Support System, Phase II

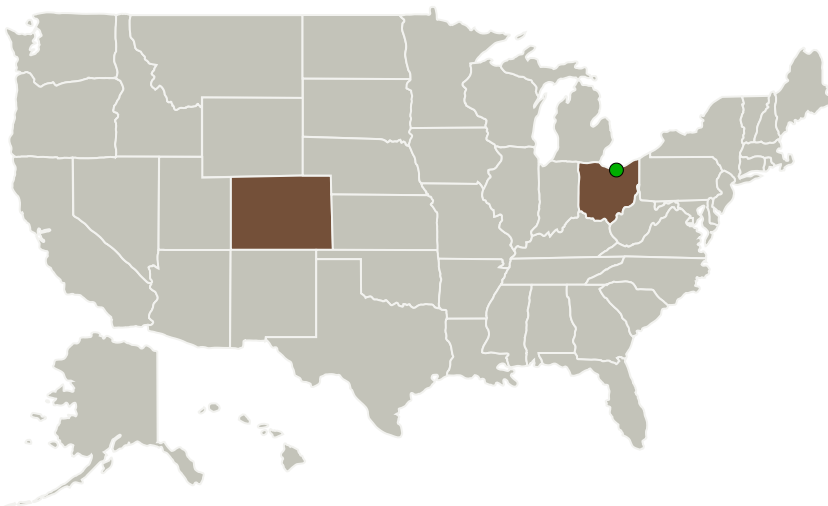
Completed Technology Project (2011 - 2014)



Project Introduction

Colorado Power Electronics (CPE) has built an innovative modular power processing unit (PPU) for Hall Thrusters, including discharge, magnet, heater and keeper supplies, and an interface module. The innovations of this high-performance PPU are its resonant circuit topologies, magnetics design, modularity, and its stable and sustained operation during severe Hall effect thruster current oscillations. Laboratory testing at NASA Glenn Research Center (GRC) has demonstrated discharge module efficiency of 96% with is considerably higher than current state of the art. The purpose of the Phase II project is to develop an Engineering Model HiVHAc PPU that includes a digital control interface unit (DCIU) to TRL 6. This will position CPE to manufacture a qualification model PPU as a Phase III project. The prototype digitally-controlled flow controller with a PC interface developed in Phase I will serve as the foundation for a combination DCIU-Flow module to be added to the PPU in Phase II. Thermal and vibration Finite element analysis (FEA) will be performed on the reduced-mass chassis designed in Phase I, and then a test brassboard PPU will be built and tested. Additionally, the control loops of the PPU will be analyzed and a stress analysis will be performed. The test PPU will be a deliverable to NASA GRC. The results of the analysis and testing will be used to design and build an engineering model flight-like PPU that includes flight-like wire harnessing schemes, EMI filtering, enhanced modularity and the new DCIU-Flow module. At the beginning of the project, the TRL of the PPU is between 4 and 5, the TRL of the DCIU is 2, and the TRL of the valve driver is 3. At the conclusion of the Phase II effort the PPU/DCIU will be at TRL 6.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Colorado Power Electronics, Inc.	Lead Organization	Industry Veteran-Owned Small Business (VOSB)	Fort Collins, Colorado
● Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations

Colorado	Ohio
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Project Transitions

**June 2011:** Project Start**September 2014:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/139054>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Colorado Power Electronics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Geoff Drummond

Co-Investigator:

Geoff Drummond

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Technology Maturity (TRL)

Start: 4
Current: 6
Estimated End: 6



Technology Areas

Primary:

- TX01 Propulsion Systems
 - └ TX01.2 Electric Space Propulsion
 - └ TX01.2.2 Electrostatic

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System